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$$\cos\theta = 1 - \frac{\theta^2}{1.2} + \frac{\theta^4}{1.2.3.4} - \frac{\theta^6}{1.2.3.4.5.6} + \text{etc.},$$

and half the difference of (30) and (31) by (29) gives

$$\sin\theta = \theta - \frac{\theta^3}{1.2.3} + \frac{\theta^5}{1.2.3.4.5} - \text{etc.}$$

The above are the required series. It is hoped that the law connecting $\cos\theta$ and $\sin\theta$ has been made plain.

(28) and (28) are Euler's results reached in a different way.

From (28) and (29) Demoiivre's Theorem, which enables us to obtain the n roots of $y^n + 1 = 0$ and $y^n - 1 = 0$, is derived.

November 4, 1893.

ARITHMETIC.

Conducted by B. F. FINKEL, Springfield, Mo. All contributions to this department should be sent to him.

SOLUTIONS OF PROBLEMS.

63. Proposed by J. A. CALDERHEAD, M. Sc., Professor of Mathematics in Curry University, Pittsburg, Pennsylvania.

I owe A \$100 due in 2 years, and \$200 due in 4 years; when will the payment of \$300 equitably discharge the debt, money being worth 6%?

III. Solution by the PROPOSER.

Let x = equated time.

Now the amount of \$100 for $(x-2)$ years + the present worth of \$200 due $(4-x)$ years hence must = \$300.

$100 + 6(x-2)$ = amount of \$100 for $(x-2)$ years at 6%.

$\frac{10000}{62-3x}$ = present worth of \$200 due $(4-x)$ years hence at 6%.

$\therefore 100 + 6(x-2) + \frac{10000}{62+3x} = 300.$

$\therefore x = 3.31533$ + years = 3 years, 3 months, 24 days.

PROOF. \$107.89 = amount of \$100 for 1.31533 years at 6%.

\$192.11 = present worth of \$200 due 0.68467 year hence at 6%.

\$107.89 + \$192.11 = \$300.

QUERY: Will the answers prove as obtained to the solutions of this problem on page 238, Vol. III.?